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The COW IN OUR ECONOMY

J. C. KUMARAPPA

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A.B. SARVA-SEVA-SANGH-PRAKASHAN

In the title we use the word 'Cow' as symbolic of cattle—the cow, its progeny and the economic order it calls for.

The cow touches all our economic activities. This had been recognised even in ancient times. That is why great importance, sentimental and religious had been attached to the 'cow.' Why Gandhiji took to the cow was for reasons deeper than this—to him 'cow' symbolized all animal world. The service of the cow was to bring him nearer to his goal of 'truth and non-violence.' All his programme sprung from this root.

Man has utilized resources of power other than manual labour for the production of his utility articles. Prior to the discovery of coal, man in the West used horse as the main motive power. Here in the East cow ruled—cow the mother of the bullock and its progeny—the bullock. We find that as the so-called industrial era dawned, the economy of the West shifted from the horse to coal and thence to petroleum. This shift meant greater and greater violence. Thus a stress on cow means bringing back mankind to its former non-violent moorings.

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By

J. C. KUMARAPPA

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Others.

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INTRODUCTION

In the title we use the word 'Cow' as symbolic of cattle— the cow, its progeny and the economics order it calls for.

In an agricultural country like ours bullock provides the back-bone for agriculture. They are the main source of motive power for this great national occupation.

A vast majority of our people are vegetarians. Milk, therefore, is the chief protein food for them. This is best obtained in the most suitable form from the cows.

Besides both cow and the bullock are our fertilizers. There is nothing to equal the quality of organic manures provided by cattle. Agriculture depends largely upon this manure.

Bullocks are again essential for our internal movements and transport of goods. These are the main facts of the problem of cow-protection which are dealt with in this booklet.

We have collected in this booklet 19 articles which have already appeared at various times in the columns of 'Harijan' and 'Gram Udyog Patrika'.

We expect this booklet will prove to be handy and useful to those interested in the subject.

We are indebted to Shri M. Vinaik for having taken the trouble to collect together all these articles in this handy pamphlet form.

T. Kallupatti
Via Tirumangalam
February, 1957

J. C. KUMARAPPA.

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PART I

I

THE COW AND PEACE*

Cattle Breeds :

Cattle breeding is a science practised of old in India. 150 years back the East India Company was developing sturdy bulls for drawing their gun-carriages. Even now we find in certain Government farms the same old and obsolete policy in vogue. At about the same period Tipu Sultan had developed a fast running breed of bullocks which served him in the Army. Lord Wellesley, who had used these in his army, was so impressed by them that during his battle at Waterloo, he is said to have exclaimed at one time when his tired horses failed to reach the goal, " Alas ! had I those Mysore bullocks, they would not have failed me ".

All over India we find different breeds of cattle. Many of these have been intentionally and intelligently bred. Now also when we want to develop the cattle wealth of the country, we ought to know the direction in which we are to proceed. There are a few points which may be well kept in view when we want to breed our cattle. Firstly, each locality has got its individual requirements according to the type of work to be done and the climate and other conditions ; over and above this, even in the same locality all people will not require the same type of bullocks. A farmer with a small holding, with work for lesser bullock power, would need a smaller bullock which he can maintain on the fodder produced in his small

*A speech delivered by Sri J. C. Kumarappa to the Go-Sevaks at Pipri, Wardha (M. P.).

field ; whereas a bigger farmer's requirement will be different. Thus we shall have to provide in each locality various types of bullocks—small, medium and big—according to the needs of the agriculturists. A mere dual purpose cow will not do for all time. We should not sacrifice special qualities for getting an average. Specialization in bullocks is a felt need. For this purpose we may not have at present a sufficient number of stud bulls to develop different types of bullocks. If we go on as we do with scrub bulls our stock is bound to deteriorate. It may not be possible to wait till we get adequate numbers of good bulls. Under the circumstances we may have to resort, for the time being, to what is called artificial insemination. I hesitate to put these suggestions before you. But I have stated the problem for your consideration.

Cow's Status :

The cow touches all our economic activities. This had been recognised even in ancient times. That is why sentimental, religious and great importance had been attached to 'the cow'. Why Gandhiji took to the cow was for reasons deeper than this—To him 'cow' symbolized all animal wealth. The service of the cow was to bring him nearer to his goal of truth and non-violence. All his programme sprung from this root.

Man has utilized resources of power other than manual labour for the production of his utility articles. Prior to the discovery of coal, man in the West used horse as the main motive power. Here in the East cow ruled—cow the mother of the bullock and its progeny—the bullock. We find that as the so-called industrial era dawned the economy of the West shifted from the horse to coal and thence to petroleum. This shift meant greater and greater violence. Thus a stress on cow means bringing back mankind to its former moorings.

Causes of War :

When we use the cow and cattle wealth as helpers in our production there is a natural limit to the quantity of production in comparison to the state of affairs that ensues when coal or other such resources of power are utilized, on the expenditure of which there can be no natural limit. Thus the self-sufficiency or the measures of it which is attainable in a cow economy is distorted and disturbed when we depart from it. When the quantity of produce increases, markets are to be sought for it. Europe's hunt for the markets in the last two centuries was motivated by this economic factor ; thus as soon as man changed over from animal economy to power economy violence became necessary. They fought with each other for markets. The result was the first World War—when the countries depending upon the coal economy fought with each other for the market areas.

Nature of Resources :

The race towards death did not stop here. It continued ahead. The resources of power given by nature are of two categories, one type is perennial in nature belonging to the vegetable and animal kingdoms. These may be called the 'current resources' and the other type is in short supply in nature like coal, iron, petrol and the like belonging to the mineral kingdom. These are not being manufactured under the bowels of the earth and their exhaustion means lessening in the total quantity available. These limited resources may be called the 'reservoir' type. It is when man depends more and more upon the latter type of resources that violence increases. Thus whereas from cow to the coal was one step towards violence, coal to petrol was a leap further towards the abyss. The last conflagration got the whole world under its sway. The

second World War was a natural corollary when exploiting countries fought not only for their markets, but also to control the motive power-producing areas. These petrol pockets, distributed over a dozen countries of the world, became the bone of contention over which the whole world fought. If we want to bring about a change towards peace we should depend more and more on the current type of resources for our motive power and 'the cow', which provides the bullocks belonging to that type, stands for it. Hence the cow becomes symbolic of an economy of Peace.

It is in this respect that I would like you to view the cow and all it stands for. Go Seva is a movement for world peace. From the mad rush to exhaust the reservoir resources of nature we want to bring humanity to realize its folly and take the help of the perennial motive power available to man in the form of our friends, the cattle. We should have a whole picture of the kind of world we want. Go Seva should help us to bring it about. I wish and hope that you will have this all-round attitude and try to bring it into practice. You would do nothing which goes against 'the cow'. The mills and all the economy which depends upon 'reservoir economy' is an enemy of the cow economy and Go Sevaks will realize that Gandhiji's cow embraces all his constructive programmes.

January, 1953. "*Gram Udyog Patrika*".

II

THE COW

The Cow Conference, held at Amritsar, in 1946, laid great stress on the place the cow holds in our rural economy. Apart from the programme for the preservation of the cow, as an animal, we have also to consider the steps to be taken to build up the economy symbolised by the cow. We cannot take up isolated items and concentrate on those without consolidating village life on all fronts.

From this broader approach any encouragement given to the cultivation of long staple cotton for mills tantamounts to the destruction of the cow as the seeds of long staple cotton are not available as cattle feed because of the fuzzy short staple cotton being left unlinted on the seed. Owing to this the bullocks are deprived of their protein diet. Our villages are dependent on animals for the satisfactory working of their economy.

The opening of vanaspati 'Ghee' mills again cuts across this economy. It deprives people of a wholesome article of diet-vegetable oil and replaces it by indigestible hydrogenerated oils and sets up unfair competition with the 'tellis'.

The building of expensive roads, surfaced with Asphalt, cement etc., while being wholly unnecessary for the village economy, takes away the part-time transportation and reduces the employment of the bullocks. Such roads encourage draining the villages of their products. They are harmful to the unshod-animals and dislocate the self-sufficient village economy.

It is not necessary to multiply instances. The cow symbolises a way of economic life just as much as the internal combustion engine and the lorry typifies another way of economic life. The choice is before us. We may choose the one or the other but we cannot make a hotch-potch of it. If we decide in favour of the cow we have to take up that economy in all its aspects.

It is imperative that the Provincial Governments, that are now seriously thinking of rural development, should clear the issues and declare for a definite line of action. No haphazard attack on this problem will solve it.

November, 1946. "*Gram Udyog Patrika.*"

III

COW PROTECTION

There is a good deal of talk today about protecting the cow from the slaughter-house. It is good that people are becoming conscious of the great evil that indiscriminate slaughter of cattle has brought to our country. On the purely short-sighted view the need for milk in a vegetarian country being important, gives a premier place to the cow as a feeder of the nation. Apart from that it also provides the bullock which is the motive power with which the farmer produces from the land. The importance of this aspect of the question has been fully realised in conferring divinity on the cow and raising cow-slaughter to the level of a religious question. However, because of fanaticism, the very same zeal on the one side has created cussedness on the other side and we often find conflict between different sections of the population centred around cow slaughter. Therefore it now becomes necessary to ascertain exactly the place of the cow in India and give it a national approach.

With an artisan the tool that he uses becomes almost an object of worship. In fact, in India we have a definite festival 'Shastra Pooja' devoted to this ceremony. Man recognises his economic dependence on the means of production. Just as an artisan depends on his tools, similarly the farmer depends on the cow and if we may extend the economic sphere, we may say the cow, being the means of producing food, becomes the centre of the economic organisation of man, especially in an agricultural country like India.

Apart from this aspect, when we look upon the cow as the producer of the bullock, the importance of the cow is enhanced. She now represents the centre of our economy. We may call our economic organisation, where the cow contributed towards motive power, transport, food production, etc, as a 'Cow-centred economy' in the same manner as England and other European Countries were, not long ago, horse-centred economies.

During the last century England drifted from being a horse-centred economy into a coal-centred economy and from being a coal-centred economy she is fast moving into an oil-centred economy. These stages are very important to notice as the fate of the world itself depends on the source from which we obtain our power.

In the cow and the horse-centred economies we have unlimited sources as we could breed as many bullocks and horses as we needed and, therefore, there being no restriction on the amount available, it does not arouse anybody's greed or jealousy ; but coal and petrol being limited in their supply and quantity, uses of such sources of power lead to friction amongst nations as the source dries up. It is now well recognised that these global wars are in no small measure due to different nations seeking to get control over oil fields. Hence the coal and oil economies lead to conflict amongst nations. Unlike these two, the cow and horse economies are, comparatively, peaceful economies. Therefore, in a wider sense we may say that when we break through a cow-centred economy we are really causing cow slaughter, i.e. in other words when our actions are inimical to the existence of the cow-centred economy, we are not in the company of the protectors of the cow. For example, when we use coal and oil as our source of motive

power we are really banning the cow from our economy. When we are making asphalted roads, which are not in the interest of animal traction, we are also guilty of breaking through the cow-centred organisation. This aspect of the question is much more vital to us than the mere slaughter of the four-legged and two-horned animal.

We wonder how many of our friends who stand up against cow slaughter can show their hands clean of bovine blood from this higher interpretation of cow protection. The 'Cow' like Khadi, is symbolic of a way of life. 'Cow Slaughter', therefore, would signify making impossible that way of life. We hope that those who stand for cow protection will realise the extensiveness of the cause which they stand for, and will whole-heartedly support this wider application of the principle.

October, 1947 — "*Gram Udyog Patrika*".

IV

TRACTOR CULTIVATION

For about a week I have been here at Pannai Ashram*. Ever since I arrived here I have been distressed to hear the buzz of the tractor. I understand that some landlords of Sindi, who own lands at Seldoh, have hired Government tractors to plough their lands. I fear these friends have not considered the consequences of their acts. I have previously pointed out the damage caused by big industries and centralisation. I shall now speak about the tractor in particular.

I hear this tractor is one of 50 horse-power i.e. it is equivalent to 50 pairs of bullocks and the charges are Rs. 60/- per day. This means that every day it works, it takes away about one khandy of jawar and leaves behind smoke. We are already poor, how can we afford to pay such charges ? On the other hand, if we used bullocks we would get rich manure with the urine and dung of these animals. This method would involve keeping cows also to breed bullocks. The cows will yield milk which is a very wholesome form of food. This is our economy. By breaking into it we impoverish ourselves.

Besides, as the tractors plough more deeply than the bullocks, unless we have more manure and more water we cannot benefit from them.

These machines cost about Rs. 20,000 or Rs. 30,000 apart from their accessories such as plough, hoes and harvesters. Mostly these come from the U. S. A. to which place we have to export our raw materials in payment. Export of raw material causes unemployment in our own land. If we send out groundnuts the *teli* loses his work and the Ghani Industry

*Pannai Ashram is the Agrarian research centre started by Sri J. C. Kumarappa in the village of Seldoh about 18 miles away from Wardha.

dies. Thus using tractors involves not only unemployment of bullocks but also causes unemployment of our fellowmen. We cannot slaughter these useless animals and men. Hence, they become a drain on the country.

The money spent on the tractor is not of use all year round. It serves only during seasons of ploughing, harvesting etc., while bullocks can be used always for drawing water, transport of goods, people etc. Thus it leads to a huge amount of capital being locked up.

When war or other disturbance occurs we cannot get diesel oil, which comes from foreign lands, as this oil will be used mainly as fuel for war machines. At such a time we cannot plough our fields as the bullocks being of no use will have become extinct by then.

Don't be carried away by the fact that part of the charges are paid by the Government. The Government itself has no money of its own, but what it gets from taxing the people. So part of the charges paid by the Government only means that the country bears the burden as a whole. So we are not receiving the service any cheaper, and we, who do not use the tractor, are also made to pay for the services rendered to the rich farmers who are the ones who use the tractors. Thus the burden falls on the poor people, also. If you do not approve of paying for rich people, you should actively oppose the Government using public money for supporting tractor cultivation.

There are many more evils which I have not the time to elaborate, but I have said enough to indicate the dangers underlying the seemingly innocent 'Help' rendered by tractor cultivation. So villagers should be warned against such dangers being imposed on them unawares, and work towards making themselves self-sufficient.

"Gram Udyog Patrika"

May, 1954.

V

BULLOCK PLOUGH Vs. TRACTOR

(*By Om Prakash Sharma M.Sc.*)

Recently experiments have been conducted to compare the efficiencies of the country plough and the tractor and it has been found that the time honoured implement—the country plough—is still a good tillage implement and in many cases superior to the tractor.

Sri A. R. Khan, the Agronomy Specialist of the Indian Agricultural Research Institute, New Delhi, conducted experiments from 1942 to 1947 with the object of studying the effect of seed-bed preparation with alternative forms of tillage implements on the yield of wheat, by the treatment and comparison of bullock and tractor cultivation on an irrigated piece of land at Karnal sub-station of the Institute.

One of the above plots was ploughed seven inches deep by the tractor implement i.e. by the soil inverting plough followed by the cultivator and the harrow. Another similar plot was ploughed to a depth of four to five inches with the bullock plough called 'Victory' and supplemented with the local country plough. The above experiments were continued for a period of six years with these implements. It was found that with the tractor implements i.e. with plough, cultivator and disc, the average yield of wheat throughout this period was 10.98 maunds per acre, while with the 'Victory' cum country plough the corresponding average yield was 12.65 maunds per acre. In these experiments the manuring and other cultural treatments were the same for all the plots. This experiment

clearly brought out that the deep ploughing of the tractor is harmful for wheat cultivation. The tractor cultivation tends to pulverise the soil too much. This encourages its packing after irrigation or a shower of rains. The air moisture relationship is thus disturbed with the result that the crop suffers.

These findings have been confirmed by numerous research investigators. Keen and his co-workers at Rothemstead have demonstrated that there was no advantage in ploughing deeper than four inches. Stameric reported in the 'Dominion Expert Station Progress Report' on the basis of over 14 years of trials, that deep ploughing was not necessary. Messrs Low and Nizamuddin in 'Agricultural Journal of India', and then Mr. Allen, in his 'Remarks on Primary Cultivation Under Indian Conditions', have shown the superiority of soil inversion by bullock ploughs in trials conducted over many years.

After establishing the superiority of bullockdrawn implements over the tractor ones under normal cultivation practice, Sri A. O. Khan along with Sri B. P. Mathur carried on some investigations with the object of obtaining experimental evidence on the moot question of the depth of cultivation as to whether there is any difference in the yields when tillage is carried out of the same depths with the bullock ploughs and the tractor discs. These experiments were conducted at the Indian Agricultural Research Institute, New Delhi for a period of two years (1950 and 1951).

Similar plots were taken. One of the plots was ploughed 9-10 inches deep with tractor soil inversion plough in the first instance and followed by normal cultivation with tractor implements to achieve a suitable seed bed for two crops, (1) Maize in Kharif and (2) Wheat in Rabi. The Second plot was ploughed five inches deep with soil inverting plough drawn by bullocks followed by normal cultivation with the local country plough.

A third plot was ploughed upto 4-5 inches deep with the local country plough without inversion throughout the season and the fourth plot was ploughed by tractor discs to a depth of about four inches. It was found that the deep ploughing with tractor gave an average yield of 37.44 maunds per acre of wheat while the shallow ploughing with tractor disc gave an average yield of 37.16 mds. per acre of wheat. The highest yield was 40.23 mds. per acre when only the country plough was used. The use of bullock soil inverting plough followed by local country plough gave a yield of 39.97 mds. per acre. All the four plots were treated in the same way as regards manures and other things. Thus we note that the deep as well as shallow ploughing with tractor gives comparatively low yields while the highest yield is given by the country plough.

With the recent advances in soil science it is becoming increasingly clear that good physical condition of the soil is as important, if not more so, in regard to its chemical constitution. The structural pattern of the seed bed or tilth was the best under shallow cultivation with country plough in the above experiments. This rendered an easy flow of nutrition to the plants and that is the reason of higher yield of wheat obtained under this treatment. Shallow cultivation with tractor disc, however, did not produce the same effect due to great pulverisation of soil, making it fluffy and single-grained, which is not conductive to good yields.

The inferences from the above experiments to be drawn are that the time-honoured implement—country plough—is still the best for ploughing. Mechanised cultivation with tractor permits speed in work and enables a larger area to be cropped, in absence of man power, but does not ensure any bigger yield.

February, 1955. "*Gram Udyog Patrika*"

VI

MILK SUPPLY

The supply of milk in our country has suffered greatly because of the war. Great many animals of good extraction have been slaughtered to supply the military needs and others still are being destroyed by one or other requirements of the military. We have, therefore, to increase the milk supply of the country. For this it is necessary to increase both the number of milk yielding animals as well asi mprove the breed of our cattle. Up to now, in many places, the Government has been developing the breed with a view to supplying the needs of the military. For this they have been breeding bulls which would give large-sized bullocks for draught purposes. These large bullocks, however useful they may be to the military who count no cost, they are beyond the means of the millions of small farmers who cannot afford to feed these huge animals. The farmer needs compact and strong bullocks for his work. Now to increase the milk supply the Government has been providing stud bulls from cattle farms, which have been working for a different purpose, with the result that the milk yielding quality of the progeny in the countryside has been much decreased in favour of producing large bullocks. This again discloses an ill-conceived plan of action. The Government should immediately take necessary steps to make their cattle breeding farms to breed animals which will meet the requirements of the people.

Again the Milk Sub-Committee of the Policy Committee on Agriculture are recommending the establishment of milk collecting and processing centres and special cold storage and

railway transport facilities. This may imply scouring the countryside for the benefit of the town. Many of the cities today depend on such milk, taken away from the mouths of chiedren of the milk-producers. Any collection of milk must take care that the milk obtained is a definite surplus over and above the dietary needs of the producers and their families. Otherwise this programme will affect adversely the health of the people in the country.

Plans and Schemes got up haphazardly are likely to do more harm than good and our second state of affairs may be worse than the first.

January, 1947.

"Gram Udyog Patrika"

VII

WHY GANDHIJI FUSSES OVER THE COW ?

(*By Bharatan Kumarappa*)

Once Smt. Aruna Asaf Ali raised a question which no doubt evoked sympathy in the minds of many. It was as to why we should trouble ourselves about the cow, when we have enough problems to tackle relating to man. Gandhiji's brief reply was that if he bothered about the cow, it was because he saw that many problems relating to man in our country could not be solved except with reference to the cow. This answer deserves to be expanded and explained, if we are to gain an understanding of the issue involved.

India is an agricultural country, with about 300 millions of its population depending on agriculture for their livelihood. For them the cow is more than their right hand, since without the aid of bullocks which the cow provides, ploughing, irrigating, weeding, harvesting, threshing, carting and marketing will be next to impossible. Bullocks are necessary for carrying on village industries like oil-pressing. At present these animals, which provide the motive power in agriculture and village industries, are weak, starved and diseased. How can people in our villages become prosperous so long as they have to depend on such a feeble instrument for eking out a livelihood ? The bullock is the villager's machine. If a man is struggling with an inefficient machine which requires repairing and overhauling, who would say, "Why bother with the machine ? Help the man'. The best way of helping him is to provide him with an efficient machine.

To this our city-educated youth may reply—"If the bullock is inefficient, scrap it, and use the tractor and other modern devices." The only difficulty about accepting this advice is that it is impracticable under present conditions. It is no use telling us what should be done at some future date. We have to face the problems of our people today, and suggest means of improving their condition under present circumstance and within the resources now available to them. Which villager can afford a tractor and other modern agricultural machinery? The bulk of them can hardly obtain a meal a day. It is like asking a clerk earning Rs. 25/- a month to go to his office in a Rolls Royce. Marvellous idea, only it is unworkable. But it may be thought that though the average cultivator in India cannot afford tractors, a Zamindar can, and the peasant can use the Zamindar's tractors. This, however, would mean, so far as the peasant goes, a condition ten times worse than at present, for at least now he is to a limited extent independent to till the soil as best as he can. But if he has to do away with his bullocks and use the Zamindar's tractor he can do so only by becoming even more dependent than at present on the Zamindar for his instruments of production, and this means for him a step nearer to slavery. If, on the other hand, it is thought that peasants can pool their financial resources and buy modern agricultural machinery co-operatively and use them co-operatively, then the difficulty is that today the co-operative movement, not being run by the villagers themselves, the people have neither the capacity nor the experience for it. Besides they would have to co-operate not only in regard to the needed capital, but also in order to pool their land resources together, for their land is at present in tiny fragments, which are far too small for a tractor. Modern agricultural machinery is useful where there are hundreds of acres to be cultivated at a stretch.

The peasant has very often only one or two acres in his ownership or control. To pool all these fragments together and to work them co-operatively is beyond his powers today.

Even later, it may not be wise for him to adopt tractors and mechanical devices in agriculture. They are useful in countries with a small population and vast areas to be cultivated. The situation in India is just the reverse. If we adopt machines to replace human beings in agriculture, where shall our people go for employment ? As it is, large scale industries are not able to absorb more than about two million and people are therefore even more increasingly being driven to agriculture for a livelihood. But if agriculture also is mechanised, it too will not be able to provide work except for a few millions, and what is to happen to the rest of our 400 million people ?

Besides, mechanization involves fuel, of which we have only a limited supply in our country.

Further, it is said that artificial manures, like Chemicals, which we shall have to resort to, if in the place of bullocks we took to tractors and other machinery, are definitely injurious to the soil. They stimulate the soil and make it produce much for the time being, but only to leave it in the end exhausted and impoverished. They are also said to cause disease in crops and in animals. This is the experience of Sir Albert Howard, formerly Economic Botanist to the Govt. of India. He is definitely of the opinion, elaborate din his book called *An Agricultural Testament* that the only manure which can permanently enrich the soil and help healthy growth in plants and animals is organic, i. e. the cattle dung and urine, human excreta, and waste vegetable matter. If this is so, then cattle will be required in agriculture, not only for labour but also for the valuable manure they provide.

For these reasons, then, it would seem best for us not to be allured into following the way of mechanised agriculture but to fall back on the bullock for motive power. If we do so, the cow which provides the bullock must occupy a central place in our national economy.

Consider further, many of us, whether for religious or other reasons, are vegetarians, and do not wish to be a party to slaughter of animals for food. Being vegetarians, we require milk and milk products to supplement the deficiencies of an exclusively vegetarian diet. We must therefore have some animals which will provide us milk. What better than the cow, the mother of the bullock which we need for our agriculture? If we look after it well, it will provide us milk for our sustenance and bullocks for doing our work.

Instead of this, the modern tendency in India is to depend on the buffalo for milk. But the he-buffalo is comparatively useless for work in the fields. So it is slaughtered. Similarly, since the cow is wanted only for the sake of its bullocks, it is sent off to the slaughter-house no sooner than it has calved, and the calf has been weaned, for it is too expensive to feed the cow till its next calving. Thus under this method both the buffalo and the cow are slaughtered.

This can be avoided if we maintain only the cow, and obtain both our milk and our bullock from it. To do this will also be cheaper from the national view point, for we shall then have to maintain only one animal for both the purposes instead of two as at present.

Further, the bullock which we want from the cow will be stronger and of a better quality, for the cow will be better looked after and fed when we depend on it for milk.

Other reasons which may be given in favour of the cow for supply of milk as over against the buffalo are (a) that cow's milk is more conducive to health than buffalo's as it has more vitamin B, and has in addition vitamin E which is absent in buffalo milk, (b) that the Carotene (vitamin A) value of cow's ghee is ten times as high as that of buffalo ghee, (c) that the cow is less liable to disease than the buffalo, (d) that it matures a year earlier, (e) that its dry period, i.e. the time from when it ceases to give milk to the time it calves again, is three times shorter than that of the buffalo, (f) that its milk yield is not affected adversely by heat and cold as the buffalo's and (g) that the cow does not require as much grazing ground, feeding and water as the buffalo.

The deterioration in the cow and its bullock is precisely because we have departed from the old practice of looking to the cow as giver of plenty. Even with all its deterioration, the Indian cow, through centuries of careful breeding, is any day superior to its Western counterpart. The fat content of the milk of the Indian cow is rarely less than 4·5 per cent while British cows yield milk of 3·5 per cent fat content only. Besides, the Indian cow can live on the meagre fodder locally available, can resist disease and withstand the tropical heat much better than the British cow. The solution therefore to the question of improving the present condition of our cattle is not to cross the local cow with foreign breeds which, as a matter of fact, has proved disastrous, for the mixed breeds cannot stand the poor feeding and the climate, nor can they provide us bullocks capable of doing hard work—but to restore the cow to the central place it once held, as the giver of milk and the mother of the bullock.

It is calculated that through its milk, bullocks, manure, hide and bone, the contribution of the cow to the wealth of

India is over Rs. 1,000/- crores annually, an amount which no other industry in India except agriculture can equal. Gandhiji has therefore established the GO SEVA SANGH (association for looking after the cow) to devote its attention on a country-wide scale to the improvement of the condition of cattle in India. Is Gandhiji wrong then to draw our attention to this most important national industry, and to show us the way to make it yield better results ?

23. 6. 46. *N.I.P.P.*

VIII

THE CASE FOR THE BULLOCK

(*By V. G. D.*)

Now that machinery threatens to overrun our agriculture and transport as a part of so-called planning, it is necessary to sum up the case for the bullock which is doomed to destruction if that threat materialized.

We must have milk, more milk and still more milk. We must therefore have cows, and if we have cows, the bullocks will be always with us, for these we have to provide and can provide full employment only if we yoke them to the plough, to the cart and to the *ghani*. If we fail to do this, we shall be reduced to the same plight as the Western nations who slaughter all bull-calves except a few which are reared as stud bulls.

The tractor is a machine ; the bullock also is a machine though not so powerful as the tractor. But the bullock is a living machine, and contact with such harmless animals has been a potent factor in the onward march of human civilization. I am not sure that the elimination of animal power and the installation of lifeless machinery in the Western countries has not something to do with the brutalization of human nature to which frequent and fierce wars bear witness in common with other evils peculiar to the West.

This is the humanitarian argument, which must be reinforced by the economic argument. We shall now deal with this latter, and in doing so make free use of a chapter in Shri N. G. Apte's Thoughts and Work about Villages entitled, "Economics of the Bullocks". (Publisher : Sri Sardesai, Samarth Bharat Press, Poona-2).

The bullock is not only a living tractor ; it is also a living fertilizer factory and gives us farmyard manure which supplies

nitrogen and improves the porosity of the soil, thus helping to increase the moisture content of the soil as well as proper aeration. These three factors are essential to plant growth. 'No amount of concentrated manure would help if the porosity of the soil and consequent aeration of the soil are not improved'.

Artificial manures are an unmitigated curse. Then there is green manuring with sunn, hemp and other leguminous plants, but that too compares unfavourably with farmyard manure. For, the green manure occupies the soil for a season from the time of planting till it is sufficiently decayed, but cannot be fed to the animals. On the other hand if we grow a fodder crop instead of the green manure on the same piece of land, at the end of the season we would get fodder enough for two animals. These animals would work for us the whole year and give us the fodder back in the form of manure better adapted for assimilation by the soil, with probably some additional nitrogen derived from metabolic processes in the animal's body.

Most of the nitrogen taken from the soil will be returned in the dung as the bullock requires only carbohydrates for work. These carbohydrates are no good as a manure as most of the carbohydrate material in the crop is fixed from the atmosphere during the process of metabolism in the plants and is not drawn from the soil. Thus the bullock utilizes the energy which is wasted when a green manure is ploughed into the soil. Then again farmyard manure feeds the soil better than the green manure, having passed through the animal system and thus having been acted upon by decomposing agents present in that system.

The bullock's function as the manufacturer of a first class fertilizer is not the only point where it scores over the machine. For, no machine ever invented can perform the various duties

that the bullock discharges. The bullock can work fast as well as slow. It cannot only be yoked to the plough, but also it can be used in crushing the earheads as well as in carting the grain to the market. All this it does, while subsisting on the straw or the cake left after the grain and the oil have been utilized for human consumption. This oil too is extracted by the same animal. A pair of bullocks costs a few hundred rupees, but if it is supplanted by machinery, the farmer must go in for an oil-engine, a motor truck, a tractor, small motor-driven harrows and what not, which would cost him goodness knows how many times as much. Then again he must purchase fuel in the shape of oil, which cannot be produced on his own field or even in his own country.

The main agricultural operations of ploughing, harrowing, sowing and interculturing keep the bullocks busy for only three or four months in the year. During the rest of the year they can be and should be used for carrying goods as well as passengers, for crushing oilseeds and so on. The bullocks are capable of doing all this, while the specialized machinery would remain idle during the long dull season.

Extraction of oil by machinery is profitable on the face of it, but the profits reappear on the debit side of the cultivator's account, with nothing on the credit side to counterbalance the debit.

We shall close with a final quotation from Shri Apte's valuable study :

"Machinery may be introduced when the existing man and animal power is fully occupied. At present this power is not fully utilized, and therefore there is no occasion for the introduction of machinery."

14th April, 1946. *"Harijan"*

IX

PASTEURISATION OF MILK Vs. BOILING

(*By Om Prakash*)

There is a race going on at present in India to copy blindly all the methods and processes which are used in Western Countries. Pasteurisation of milk is part of it. Time and again voices have been raised against this craze of mechanisation of the industries which affect a great many of our masses. A scientific study of the process of pasteurisation of milk has been made and it has been found that there are more viable bacteria left in the pasteurised milk than are found in the fresh sample in the milking pot due to the tropical climate of India.

In Western countries pasteurisation and immediate refrigeration is the legal standard of preliminary treatment of milk. The presence of bacteria in milk in large quantities is the cause of many diseases. Hence methods have been developed to check the growth of bacteria in milk and pasteurisation is one such. This practice is also adopted in the military and civil dairy farms in India. In all the big cities pasteurised milk is supplied by some Government and public agencies.

Drs. Rangappa and K. T. Acharya of Indian Institute of Science, Bangalore had studied this problem. They found that at the time of milking the number of bacteria per c.c. in the milking pot was 6,300. If left over for two hours after the milking, the number of bacteria becomes 2,25,000. If the milk is pasteurised within a period of 2½ hours after milking, which is also a general practice in all the dairy farms, the number of bacteria per c.c. comes down to 9,400. In a well knit organisation the pasteurised milk is bottled within half an

hour after pasteurisation. When after this period i.e. 3 hours after milking, the bottled milk was tested for its bacteria count, the number per c.c. was found to be 15,000. Pasteurised milk 18 hours after milking, was found to contain 1,21,000 bacteria per cubic centimeter. Hence, it is evident that in spite of the elaborate process of pasteurisation and subsequent cooling of milk, the number of bacteria is more than in the fresh milk. Besides, the quick multiplication of these bacteria under ordinary conditions of preservation shorten the life of milk.

That this method of treatment and preservation in cold storage is not commendable to the Indian farmer, not only from the point of view of economy but also from its unsuitability under tropical conditions, has been emphasised by Write in his 'Report of marketing of Milk in India and Burma, 1943, P. 213' on the development of the Indian Dairy Industry. The expensive and the elaborate nature of the equipment are obvious drawbacks, while its sterilising efficiency is questionable.

In contrast to this method of processing the simple boiling is best suited for Indian rural conditions. Sris Srinivasan and Banerjee have investigated the bacterial destruction after pasteurising the milk and have compared it with the methods of steaming for one hour in an autoclave at atmospheric pressure and boiling. When a sample of raw milk containing 120,000 bacteria per c.c is steamed for one hour the number of bacteria reduces to 100 per c.c. when a sample of raw milk containing 1,50,000 bacteria per c.c. is boiled for 5 and 10 minutes its bacteria count is reduced to 5,000 and 30 respectively and when it is boiled for such a time so that its volume is reduced by 5% and 10% respectively the bacteria count is reduced to 23 in both the cases. When a sample of the milk boiled for 10 minutes is cooled and kept at room temperature for about 8½ hours the number of bacteria is only 3200 per. c.c.

Hence, the method of boiling milk for 10 minutes is evidently more efficient than pasteurisation. It has also been found that fresh milk so processed keeps for more than 24 hours at room temperature when cooled in a closed vessel and then stored. This method is perfectly suitable to Indian conditions where the farmer and the housewife have to store a small amount of milk. It needs no special equipment and demands but little skill.

Not only this, the quality of boiled milk is comparable to that of pasteurised milk though variations take place in the composition of milk, physical nature of its constituents and its digestibility when milk is pasteurised or boiled. Yet the protein, fat, lactose and mineral constituents remain practically the same in both the cases. While vitamin A of the milk is not destroyed by boiling, about 22% of vitamin C is lost at the first boil and 66% after 10 minutes of boiling. Exposure to light of the raw milk also causes the loss of vitamin C. Vitamin B1 (thiamine) and vitamin B2 (Rib oflavin) are very little affected by this type of processing or preservation of milk. All the enzymes of milk, which alter the rate of chemical reactions, are all destroyed when milk is pasteurised or boiled. As regards the digestibility of milk it increases in the order raw, pasteurised and boiled.

Thus we see that our centuries old method of boiling the milk is not only safe, easy to handle but scientific too.

April, 1954. "*Gram Udyog Patrika*"

PART II

THE SOIL

X

SOIL FOOD Vs. DRUG

In human nutrition people recognise the difference between staple food and drugs. Usually the staple food is eaten in large quantities and it contains all the elements necessary for the human body in the right proportions or nearly in the right proportions. Milk for instance will contain fat, proteins, calcium and vitamin A besides other similar ingredients. But, if for any reason, the body of a patient needs more vitamin A than is found in milk because of some diseased state of the body, then to augment this need Vitamin A may be administered in the form of some liver products, such as, shark liver oil or cod liver oil. We recognise, therefore, that an ordinary wholesome food differs from medicines. Medicines are administered in small doses according to the needs of the particular patient and his condition. An old man may take a different dose of medicine from that of a middle-aged, the latter would need a different dose from that of children.

Again certain drugs are used as stimulants when individuals want to go beyond their energy provided by nature, by indulging in dances at night clubs ; such individuals stimulate their bodies to meet the extra demand of energy by taking injections of morphia and other such drugs. For the moment they appear to be full of vitality and energy, but a time comes when they suffer from the reaction of stimulants. Therefore all persons desiring to lead a normal life without overstraining the nervous or muscular system, will content themselves with a healthy use of energy produced in normal food.

Medicines are indicated in case of the existence of pathological conditions, while stimulants are harmful to the body as they overtake the system. Thus staple food, medicine and the drug each has its own place and cannot be substituted one for the other. Food for the normal person, medicine for the sick person and the drug for the over indulgent.

Similarly, in plant life too, we have these stages. Plants, like animals, need food. They draw this food from the air and the soil through the medium of water. If the normal food that the plant requires is deficient in particular aspect, that deficiency may be made good by a proper diagnosis and prescription. Also plants can be stimulated with drugs like human beings. But that is an unnatural situation. In nature much of the mineral substances needed by plant life is provided in some assimilable form by micro-organisms in the soil. These micro-organisms take organic matter and present them in an assimilable form fit for the plants. In the normal way, the animals feed on vegetation and after assimilating that which is needed for the energy and growth, they pass out the rest back to the earth and these micro-organisms in the soil, convert such material again into plant food, and so goes on the cycle in nature. Any interference in this by men can only be justified by the circumstances.

The natural staple food of all plants is farmyard manure and other organic matter. Such manures have in them certain elements termed auxins which help better assimilation of the food just like vitamins in human food help in the biochemical process. The auxins are indispensable for the plant life, just as vitamins are indispensable for human beings, and farmyard manure and other organic matter are rich in these auxins.

Where the mineral contents of the soil may be deficient owing to flooding and washing away of certain mineral salts,

it may be necessary to supply that deficiency by introducing certain chemicals. But this is a process which is analogous to medicine to the human body. Just as medicines can only be administered by a qualified doctor after a careful diagnosis with a prescription suited to the particular conditions of the patient, similarly this method of adding chemical fertilizers to the soil, should only be done after a careful analysis of the soil and the requirements of plant life to be raised on that soil. Without such proper prescription given by a soil-chemist, to freely use chemical fertilizers would be foolish as a layman administering medicine to a patient and it may be equally tragic in its results. Artificial fertilizers, therefore, are not plant food but they are medicines to the soil.

Just as the human system can be stimulated beyond its normal performance by drugs such as morphia, similarly plants also can be subject to an unhealthy enhancement of their growth and production by the use of drugs. Chemical fertilizers can produce this effect ; but it is an unhealthy, short-sighted and unnatural state of affairs.

If our agricultural food production is to supply the normal requirements of the human body, the plants from which we draw that food must also be healthy, normal and well-fed. Any artificial stimulant or artificial feeding will naturally affect our food, as we depend upon, specially in our country, so largely on plant life for our food. Hence it becomes imperative that we should watch the food given to these, the medicines administered and the drugs supplied. If there is any undue dose at any stage it will ultimately tell on the health conditions of the human being using that soil.

New Zealand grows most of its food supply on soils manured by chemical fertilizers and it was found that the people

of New Zealand were subject to catarrh, influenza, septic tonsils and dental caries. Therefore, Dr. Chapman of the Physical Mental Welfare Society of New Zealand carried out experiments in Mount Albert Grammar School Hostel, and subjected over 60 boys, teachers and staff to experimental feeding. The food was changed from the "Chemically grown" fruits, salads and vegetables to articles produced on farmyard manure; and he reports, "There is a marked physical growth and freedom from other common ailments, and their dental conditions have improved". It may be noted here that during the last war, when young men were examined for recruiting, over 40% of the New Zealanders were found to be unfit because of defective teeth. This experiment gives the warning that if the health of the people of India is to be what it should be, we must beware of chemical fertilizers. This purely from the point of view of our food.

Looking at it from the needs of the soil, chemical fertilizers increase the acidity of the soil. Parts of Bengal and Bihar have already suffered from this. To make the fertilizers effective, it is necessary to apply it at a suitable depth and not as a top-dressing. Application of manures at some depth involves deep ploughing and copious irrigation. In our country, where the majore portion of the land is subject to the vagaries of the monsoon, it would be a pure gamble to plough deep and manure it with expensive manures only to find at the end of the season that the rains have failed. Our farmers are not financially well-off enough to take the risks of this type of land treatment. As we have already indicated earlier, before artificial fertilizers can be used on any plot of ground a very careful analysis of the soil and its requirements have to be ascertained. This involves a wide-spread, well-trained, expert staff of agricultural chemists who could function as "Soil doctors." Before we have such

a personnel available at every plot of cultivable land, it will be sheer folly to put artificial fertilizers in the hands of the farmers. It will be like handing in poison-drugs like opium, morphia etc. into the hands of ignorant patients without any control as to their use. Therefore, even if we wish to introduce fertilizers as medicine, the condition precedent to such a course will be the introduction of agricultural chemists in large numbers. In our country we have not got physicians even for human beings in sufficient numbers. Where are we to find soil physicians in greater numbers ?

With these facts before us we regret to notice that our ill-advised Central Government is pushing on with the promotion and extension of artificial fertilizer factories. In Bihar at Sindhri, a scheme for an artificial fertilizer factory, involving foreign machinery to the extent of Rs. 12 crores and other buildings and equipment running into a further 10 crores, is being pushed forward.

We hope better counsels will prevail and the suicidal schemes will yield place to carrying on researches on more healthy lines which will provide a considerable amount of the organic matter that is going to waste today as suitable manures to our fields. Only such a course will provide us with health-giving food and save us from the unscrupulous exploiters who, regardless of the harm they are causing the people, consider accumulation of wealth the only objective in life.

Sept. & October, 1947. *"Gram Udyog Patrika"*

XI

MANURES AND FOOD

Few people realise that the quality of the health, growth and reproduction of plants, animals and human beings depend a great deal on the quality of manures that are fed to the soil. When we put manure into the soil we are feeding the soil and to the extent the soils are fed the produce of the soil will also be nutritive, and the products of the soil are usually the basis of the requirements of animals and man. The cycle is not complete here. If the soil produces good food for animals and men that food, when digested and returned back to the soil again, is also a better soil food. Thus the circle of goodness goes round and round rising in a spiral for the benefit of plants, animals and human beings. There is an old saying, "Who feeds well—manures well." We may put in a complement of this, "Who manures well—feeds well', thus completing the whole process.

With the deterioration of our soil technique the farmers also have deteriorated in their health and with the deterioration of their health they have not the energy nor the staying power to cultivate well. They have not been as manure-conscious or selected-seed-conscious as they should be for decades with the result that our whole agricultural produce has gone down in quality and quantity. We have to resuscitate our agriculture. Many have thought it fit to solve this problem by the introduction of mineral or chemical fertilisers.

A Stimulant :

Mineral fertilizers do not feed the land. They merely excite it to a certain extent like a stimulant and thereby it apparently

increases production without a proportionate increase in the nutritive values, with the result that mineral fertilisers progressively deteriorate the health of animals and men as the food products raised on fertilisers are not products of a soil that has been fed but one that has been merely stimulated. This effect has been brought out by many experiments which have led to the following conclusion :

1. Animals fed with wheat grown on land fertilised by farmyard manures were notably stronger though their weight may be less than those nourished with grains grown on lands fertilised by chemical manures.

2. Hens brought upon feeds grown on farmyard manures laid more eggs than those brought upon feeds from minerally fertilised lands, though the latter were heavier, yet the larger number of the former more than madeup in quantity as well. The birds brought up in the former way stayed out of their pen longer than the birds brought up on the latter feed, thus bearing witness to their greater vitality. Even the vitality of the eggs of the hens fed on grains from farmyard manure was greater in that larger percentage of such eggs were hatched and few of them were spoiled by keeping.

3. The manure produced from the refuse of poultry fed from grains raised on farmyard manure also was very effective compared with the manure of birds fed on grains raised on fertiliser lands, showing that the quality of the manure itself is influenced and improves new growth in the form of seed and feed. In this way the farmyard manure promotes a cycle which leads to a constant improvement from generation to generation.

Apart from these experiments it was also noticed that when animals are given a chance of choosing between feed

that is grown on artificial fertilisers and the feed grown on farmyard manure, they instinctively prefer the latter.

A Danger :

In our country scientific fertilising of our land by mineral fertilisers is an impossibility as we have not got sufficient soil chemists who can analyse samples of soils sufficiently extensively to be able to feed the soil accurately even if artificial manure is to be resorted to. Any excess feeding of the soil with such minerals creates diseases of all kinds. Many experiments have been carried out which show the danger of an excessive mineral content in the soil. The data obtained by Pro. Rost of Mannheim, demonstrate that an excess of potassium in the land is likely to lead to diseases such as Thrombosis (coagulation or curdling of the blood) as well as to Gangrenes. He observes, "In connection with the potassium nitrate fed animals, they showed a tendency, a pronounced inclination in successive generations, towards Thrombosis." He also states that in recent years Thrombosis has increased in human beings to about four times its earlier prevalence.

Disease Resistance :

The many experiments that have been carried out show that the seeds and better still the leaves of plants fertilised with stable manure increase the capacity for disease resistance when fed to animals as compared with seeds and leaves of minerally fertilised plants, thus showing that the manures not only improve the soil structure but the consequences of manuring projects itself far into the animal kingdom reaching out to man himself. Therefore it behoves everyone of us to take care that such food as we eat is grown on land fertilised with farmyard manure and not with chemical fertilisers, especially where there is a

danger in our land of unscientific application of fertilisers for lack of soil analysis ; it is not only the farmer who is interested in the manure, but perhaps to a larger extent, the consumer should be made conscious of this as it is he who is likely to suffer by food raised on artificial fertilisers.

Medical Use :

Taking advantage of this effect dieticians are now treating their patients on food which is grown on farmyard manures which are generally called " Biodynamic products ". Such feeds are said to affect the functioning of the stomach and intestines favourably. A German dietician writes, " I have recommended these products to patients with main stomach trouble and sluggish intestinal activity and they have been fortunate enough to get over these ailments without medical treatment. My wide experience, as a dietician with many patients, has convinced me that especially with raw-food diet the biodynamically treated products are preferable in every way to those which have been manured with chemical fertilisers."

Ghemrat Abderhalden, the famous physiologist, states, " In connection with various illnesses of man and animal it has frequently been desirable to trace them back to the method used in fertilising food plants. Though we may not be able to say anything very definitely yet in regard to these matters it is clear that soil bacteria do play an important part in relation to our health. We have, therefore, to consider whether it is worthwhile to disturb the interplay of soil organism by using lime and phosphoric açid, as these disturb and hinder the working of the soil bacteria."

The Government of India is spending over 20 crores of rupees in a fertiliser factory in Bihar and in Travancore also a

large fertiliser factory has been established. It ist ime that the Food Department takes up the case on behalf of the consumer. Already our people are emaciated by diseases of mal-nutrition. Need we worsen the health of our people by introducing chemical fertilisers ? This is a grave responsibility. We hope the Health Department also will combine with the Food Department and set things right in the Agricultural Department.

March, 1949. "*Gram Udyog Patrika*"

XII

TRAIN BEARERS OR TORCH BEARERS ?

In the West, the bride wears a wedding robe which has a long train–a superfluous flow of garment–sweeping the floor. This wholly unnecessary and cumbersome appendage is carried by little boys 'pages'—train bearers. Our country is fast becoming a 'train bearer' of outmoded methods of Western countries.

The Government of India is going ahead with the putting up of artificial fertilizer factories and sending out young men to be initiated into the secrets of this industry. Agricultural countries like Australia and the United States of America have found from experience that stimulating the soil by chemical manures produced seemingly good crops, but that these products were deficient both in mineral and vitamin's content and that the plants themselves were weak in disease resistance to pests and parasites that attack them. While these chemical fertilisres helped in using up the humus already present in the soil, they did not help in replacing the needed humus for the next crop, thus helping merely in the rapid exhaustion of the soil. With this experience they are now turning towards ways and means of feeding the soil by following the technique of organic farming.

To this end their Scientists are hard at work to discover methods of feeding the soil rather than merely stimulating it. It is reported that J. W. Frazer and Eric Eweson have developed a method of composting organic waste of cities. In their plant in Pennsylvania they use factory waste and sewage matter.

They claim that soil already exhausted can be re-fertilised in two years by the use of such compost manure.

Is it not high time that the Agricultural Research Department turned to such uptodate methods and be torch-bearers of progress rather than run after the discarded chemical fertilizers ?

May, 1949. "*Gram Udyog Patrika*"

XIII

WORM MINDEDNESS

India is made to waste crores of rupees on building artificial fertiliser factories. Without an army of soil-analysts all this effort may even turn against us in this land where we have an annual gamble with the monsoon. All this in the name of Science !

The more progressive agriculturists elsewhere are turning to nature for help. In Australia they have discovered the enormous dependence of man on worms, so much so that worm-rearing is becoming an industry like bee-keeping.

Earth worms live on the humus in the soil and convert it into assimilable manure. They bore their way into the soil which gets loosened and aerated by this process and water also percolates through these. Worms cannot live on chemicals. They need farmyard manures or compost. Artificial fertilisers kill these friends of man.

Harold Karp of Randwick, Sydney has registered a business concern " Earthworm Enterprise " and has built up a " Stud of half a million worms. He says if home gardens used more worms they would get better flowers and vegetables. With a box of 250 worms as breeding stock any garden can be started on the way to high fertility. He hopes to sell his worms at about £. 1 per box.

We hope our agriculturists will also become worm-minded.

July, 1949.

" *Gram Udyog Patrika* "

XIV

A WARNING

A news agency report states that Prof. Einstein has sent a message to the people of our land warning us that chemical fertilisers and tractor ploughing will ultimately bring in loss of soil fertility causing incalculable and irreparable harm to the country eventually. Curiously enough the bearer of this message is Dr. Amarnath Jha himself.

Great many experts before Prof. Einstein have advised Western farmers against the use of these instruments of a short-sighted policy. Our country is always about a century behind. What has been discarded by Western Scientists, our experts cling to as the last word in progress. It would not matter much if our scientists were left to hold their antiquated views in their laboratories, but the tragedy of it is, our vested interests have used them for propaganda purposes and have induced our Government to squander crores of public money on importing tractors and establishing fertiliser factories.

As it is, the pressure on land is such that it is not able to provide adequate food for the people. What we need is a programme of rational use of land combined with provisions of ample fuel resources to release farmyard manure of the fields. Instead we are faced with converting, what is today a reasonable fertile soil, into desert land by our greed for quick returns. No doubt the use of fertilisers will stimulate the soil into yielding more for a time, but soon, like the energy of the drunkard, it will disappear, making the second state worse than the first. Shall we be guilty of killing the goose that lays the golden egg ?

If it was merely Prof. Einstein's personal view it may be dismissed lightly. This opinion is the result of extensive use of fertilizers and tractors under very favourable conditions both in the U. S. A. and Australia.

We may remind our readers that not long ago Mr. Collin Grant Clark, the Australian economist, invited to advise our Government, said that he would develop India on the basis of cottage industries regarding the factory as a necessary evil. Surely these men cannot be accused of being fanatical Gandhites trying to put the clock back. Shall we heed the call of wisdom based on experience or go our own way to destruction ?

The impact of the West disintegrated our industrial set up. Is it left to a national Government to convert our fields into deserts ? May God forbid.

July, 1948. "*Gram Udyog Patrika*"

XV

BOYD ORR, DODD AND OURSELVES

A few months ago Lord Boyd Orr was invited to advise the Government of India on the food problem. Considering the extent of food shortage and the chances of increasing food production he held, we could be self-sufficient in food only if the problem were treated on a war basis. He stated, "India has got to throw herself into this drive for increased food production with the same enthusiasm and the same energy as she would if an enemy were at the gates. The enemy is at the gates—the enemy of hunger". It is on this advice that our Food Ministry has built up its hope of reaching this goal by 1951.

Is the condition precedent present ? Is Government machinery going all out to meet the situation ? Under war conditions every other objective is eclipsed by the predominant emphasis given to the war effort. Austerity and self-control assume command and banish self-indulgence and extravagance. Let our leaders set the pace and indicate their earnestness. This cannot be done by orders of Rs. 1,000 worth of *Rasagolas* from Calcutta or bringing musicians from Kashmir for garden parties. This state of affairs is a denial of the existence of the very basis on which Lord Boyd Orr's optimism was built. The man in the street cannot visualise thousands of tons of food shortage in this vast country but he can appreciate a situation which makes the leaders tighten their belts.

There is hardly any co-ordination between the various departments. Each one is hibernating in its own water-tight

compartment. Even high-placed non-officials at the centre with access to the ministers concerned are unable to obtain selected seeds or manure or other technical aid from the Agricultural Department while the food department concerns itself with paper propaganda. It is but natural as these departments are presided over by the hidebound civil servants whose knowledge of field work is practically nil and whose prospects are tied on to effluence of time rather than to any criterion of efficiency. Hence all that they are concerned with is the passing of time. In this art they are masters. Therefore one of the preliminary steps must be to place men who know their jobs, not files, at the head and set before them a definite target of attainment in a given time. When they fall short of the target, they should not be promoted to a bigger job, as is the case now, but just 'sacked' for good and all. Perilous situations call for stern measures.

A little later on Mr. Norris Dodd, the successor of Lord Boyd Orr as Director General of the U. N. Food and Agricultural Organisation, sounded a more pessimistic note. He thought the situation could be improved in about 10 years so as to reduce the present imports of food of 4 million tons to about 1½ million tons.

He further ventured to advise our highly paid 'modern scientific and progressive' arm chair technical experts. He wanted to limit mechanization to the breaking of new land and terracing to avoid soil erosion and suggested that instead of going in for extensive use of artificial fertilisers they should utilize clover crops for their nitrogen restoring and water holding properties. He felt confident that only by observing these principles and by control of soil erosion by strict limitation of forest cutting and with the extension of tube well irrigation could India eventually solve her food problem.

He was quick to recognise the folly of attempting 'to revolutionise' long established agricultural practices by the adoption of large scale farming methods of the West." There is a world of difference in the principles governing Agriculture as an industry and Agriculture as an occupation. In America Agriculture is as much an industry as the Motor Industry. So the principles that enter into their consideration are much the same. While in India the circumstances surrounding agriculture are fundamentally different and call for a different set of principles in dealing with them. For instance, cooking in a hotel follows certain considerations of cheapness of materials even at the cost of quality, but this is not so when a mother cooks for her children. In the former, cooking is an industry while in the latter case, cooking is a profession. This difference has to be borne in mind while dealing with Agriculture in our country and not try to import capitalistic principles where capital is scarce and labour is in abundance.

July, 1949. *"Gram Udyog Patrika"*

XVI

FEEDING THE SOIL

(*By V. Padmanabhan*)

Nature has a definite way of doing its work. If we understand and help in its work, it is bountiful in its reward. But if we are callous of or obstruct its way it punishes us. If we can stretch our imagination a bit we will clearly understand how it is the soil that makes the existence of man, animal and plant possible. But each in its turn is dependent upon the other. This inextricable and inescapable relationship between soil, plant, animal and man should never be slighted. Even so, ultimately it is the soil which sustains the rest. Just as there is life in man, animal and plant there is also life in the soil. This might look strange but it is profoundly true. One never sees the millions of micro-organisms that are ceaselessly working in the soil and are part of it.

Man in his quest for his food and the animal, which helps him to get it, often forget that the living soil has also to be fed as the animal or plant, if it is to live. The plant derives its life from the soil. But how can the soil give the plant its life if it is not itself living ? How then does soil live ?

A living man breathes the air and a living soil has to have humus to make it live ; else, it will be dead and its death will be also man's death.

Humus is the product of decomposition of animal and vegetable wastes through the action of bacteria, hence we have the law of return. Whatever is thrown away by man and animal should be returned to the earth. That does not mean that we

should just throw all refuse some how on the soil. The soil should receive it in a cooked or digestable form. It should be in the shape of humus. Therefore it is imperative that all animal and vegetable wastes are converted into humus before being given to the soil.

How can we do this ? Often humus is understood to mean organic wastes or farmyard manure. These are only the raw materials from which humus is manufactured. They become humus only when they have been acted upon by the soil-fungi and bacteria or to put it chemically when they have been metabolised by soil organisms.

The Chemistry of humus is derived from the final decomposition of the plant and animal residue through the agency of the micro-organisms. Several organic complexes mainly consisting of lignins and legnin derivatives and proteins are contained in it. Largely the chemical formative of humus depends on the nature of the wastes forming the raw material, the process of decomposition and its extent. The carbon-nitrogen ratio of humus is about 10 to 1, while the raw materials of vegetable and animal waste have a carbon—nitrogen ratio of about 33 to 1. Large volumes of carbon dioxide, CO 2, is evolved during the action of the fungi and bacteria. Naturally, therefore, a good deal of atmospheric oxygen is required for this.

Air is the pre-requisite for the manufacture of humus. So when we are trying to compost things we should never forget that the manure pit should have ample circulation of air. This is obtained by building up a pit with layers of loosely spread out vegetable wastes. Never should a layer be trampled while building up. Another method, which helps aeration, is the building up of pits in sections of not more than three feet breadth.

Bacteria thrives well in a moist atmosphere and so any pit must have enough moisture if composting is to go on well. The amount of water needed depends on the climate of the locality. It must be of the nature of a squeezed-out sponge. It must neither be dry nor be sodden. Any body can learn this after a little experience and practice. To maintain the moisture of the pit a roof is absolutely necessary. Too much water is also harmful and so the roof will, in addition, protect the pit from rain. Besides, the roof prevents the heat of the sun from directly striking on the pit a d upsetting its temperature violently. For effective decomposition, temperature is the most important factor. What should be this temperature ?

This we can understand only when we know the action of the micro-organism. The process itself consists of two stages, the first stage passing on for the first 3 or 4 weeks. The whole mass will be found to be covered by a greyish white mycelium. The action is mainly serobic depending upon air for its life. It may be called the fungus stage distinguished by the greyish white colour of the mass. The fungi responsible for the decomposition thrives best between 95 degrees F. and 130 degrees F. But always fermentation in newly formed heap follows a rapid rise in temperature shooting up at times to 165 degrees F. This precisely is why there should be an undisturbed and ample supply of air. The air helps to bring down the rising temperature to that optimum level which is best suited for the fungi.

The second stage, which we can name the bacterial stage, is quite different. The action now becomes more anaerobic. The bacteria is capable of living in an atmosphere with less of oxygen. It thrives best between the temperatures of 150 degrees F. and 180 degrees F. In this stage one can visibly see

the heap crumbling down and closing the air spaces and preventing any lowering of temperature. The heap assumes a dark black colour now.

To avoid any excessive acidity earth, sea, sand, wood-ash or a mixture of all these should be used.

So that for the manufacture of humus we need vegetable wastes, animals wastes and a base. Now how can we mix all these and in what proportion ? It is calculated that ordinarily one pound of nitrogen is needed to every hundred pounds of dry vegetable wastes. In actual practice it would be in the ratio of 3 parts of vegetable wastes to one part of farmyard manure.

To combine all these we should just spread out the vegetable waste in a layer above 6 inches thick. Over this we spread out another layer two inches thick of farmyard manure, then sprinkle some earth. Thus we pile up layer on layer. The vegetable waste sandwitched between that of the base and the farmyard manure would keep the mosture and the air circulation continuous. For easy piling up we can take a section of three or four feet, and build up to a height of 5 feet and then take to the next section. This would also facilitate on ample supply and prevent trampling while building up. To prevent formation of a silage it is best to see that the green materials do not exceed more than half of the waste. All wastes should be thoroughly mixed and long branches etc. cut into little bits.

October, 1951.

"Gram Udyog Patrika".

XVII

SOIL AND HEALTH

(*By Wilfred Wellock*)

What is Soil ? The necessity of humus proves that soil is chemicals plus something without which it will perish, turn to dust and become a desert. We also know that before that stage is reached, plants will weaken and lose their power to resist disease, whence insecticides, fungicides and virucides must be applied in ever increasing numbers and quantities. Many of these chemicals poison the soil and thus further weaken the plants that are grown in it, and reduce their food value. The latest attempt to over-come these pests include soil sterilisation, as in greenhouse tomato growing, but something happens which robs the fruits of flavour, and flavour is connected with mineral and vitamin content. Lack of flavour in tomatoes is now a common complaint.

There thus occurs a vicious chemical cycle of debilitated soil, devitalised plants, disease and pests, poisonous sprayings and further debilitation of soil and plant. Then devitalised food, deficient in vitamins and minerals causes deficiency diseases in humans for which doctors prescribe more chemicals, thus starting or strengthening a drug habit which may have serious consequences. The big chemical interests, be it noted, make huge profits throughout this vicious cycle.

Chemical "Foods" :

Humus feeding of the soil is in the natural order, and may be studied in detail on every forest floor. All manner of animal and vegetable wastes are transformed into organic forest food

by bacteria in rich friable soil. Chemical "Foods" on the other hand, being soluble in water, pass directly to the plant without going through the life cycle.

A Garden Never Sprayed :

Chemists claim that chemicals are the same whether they be produced organically or inorganically. Be that as it may, experience proves that organic nitrogen, e.g. possesses qualities which are not possessed by inorganic nitrogen. There is a plus which makes all the difference. It gives to plants a content which pests do not like and so makes them disease resisting. Pests visit them, but they do not stay, as I have myself witnessed. In my previous garden, which I never sprayed, all my apple and pear trees remained singularly free from disease, even when trees, but a few yards away, were infested with it. I have also observed that sickly trees and plants are more subject to disease infestation than are healthy ones.

Sir Albert Howard :

It is thus my deep conviction, proved by experience, and that of thousands of organic or compost growers, that the secret of health from the soil to plant, animal and man is a living soil which teems with bacteria and small life including worms, which in addition to transforming vegetable matter into plant food aerate the soil. I have composted vegetable wastes for about seventeen years, but it was not until I read Sir Albert Howard's "An Agricultural Testament" (published in 1941) that I got down to the roots of the problem of soil feeding. What chiefly attracted me in this book, as I afterwards told Sir Albert, was that it demonstrated a "Way of life" for plants which harmonised with my views of the causes and cure of human diseases and which I had been adopting in my personal life for many years. Sir Albert worked on the principle that a healthy

plant or animal would resist disease, and he proved his case by ridding tea plantations in the state of Indore, India, of pests which were threatening their existence. Moreover he there fed his draught oxen on compostgrown food, which thereby became so healthy that he was able to put them among oxen suffering from foot and mouth disease with complete immunity. (In 1952 foot and mouth disease cost Britain £1,750,000). Some years later Sir Albert restored to health and disease-resisting power a disease infested orchard in Blackheath by organic feeding alone.

Dieting :

I have experimented with dieting throughout my adult life, to my great profit in health, enjoyment and understanding. I have proved conclusively that it can resist disease. Having thus kept myself outside the drug or chemical cycle all my adult life, it seemed to me natural to try to keep my plants and trees outside it also. For demonstration purposes I have brought on diseases and then got rid of them solely by diet. Hence I agree with Hippocrates : "Let food be your medicine and medicine be your food".

Two Meals A Day :

Both selection and quantities of foods are important. For over forty years I have lived on two meals a day. This habit gives the stomach a complete rest daily, and thus enables it to derive more nutrition from a given quality of food. It is thus an all-round economy. I have also discovered the wisdom of limiting the intake of sugar, starch and protein, specially sugar, and of eating freely of fresh fruit, green vegetables and salads, substituting fresh fruit for sweet starchy puddings. Whole-wheat bread is another basic necessity of full health. A sense of physical fitness, of wholeness and self-

possession is my unfailing guide to feeding and other habits. No pleasures of the flesh are comparable with that acquisition.

White Bread :

At every level of life from the soil to man it is possible to function within an organic or an inorganic cycle to varying degrees. Most people function in both cycles without realising it, since so many chemicals are now used in the growing and processing of food, and as medicines. White bread is first robbed of natural minerals and vitamins and then fortified with chemical vitamins, while sweet synthetic concoctions, now so much in vogue, clog and debilitate the blood stream and drive their victim to the drug chest.

Carrots ?

Thus the chemical cycle is growing. We rarely know what we are eating. I read recently of some fine looking carrots which, on analysis were found to contain not a trace of carotene, the vitamin for which the carrot is recommended. Could they, therefore, legitimately be called carrots ? Need we wonder that the number of people, who are being propped up by drugs and who linger on in the twilight of phenobarbitones, is growing ?

Egg ! Or Not ?

Another aspect of this decadence is the conversion of animals into food-producing machines by unnatural, pressurised techniques. Poultry, e.g. are increasingly being subjected to batteries and deep litter, artificial heat and light, and food which simulates the ovaries. Chicks of good stock are reared in natural conditions, with grass-runs, etc., until the egg laying period commences, when the above named pressures are applied. Eggs are then produced at a rate which exhausts the birds in one laying season. Then they are sold for the table and a fresh

start is made with one-day old chicks. As the point of exhausion approaches, the shells of the eggs become thinner and thinner and the yolks paler and paler until they are almost flavourless. The question thus arises : When does an egg cease to be an egg ?

What about Milk ?

Cattle also, in the interest of big milk yields, are being fed on highly stimulating food, a policy that is being attended by a serious fall in the average number of lactations per cow, the prevalence of foot and mouth disease, mastitis and abortion.

The Temptation of the Age :

Quantitative output in industry and agriculture is resulting in fragmented persons, disintegrated families and communities, on the one hand, and in weakening soils, plants and animals, multitudinous pests and greatly increased drug taking, on the other. Soil and health are integral factors in the study of the decay and reconstruction of Western civilization.

Quantitative output in industry at the expense of distinction and quality and of human personality, and in agriculture at the expense of quality and of health from the soil to man, in the interest of profit and economy of labour, is the major temptation of our age. But it is a short-term policy which points to the termination of Western civilization on the same broad grounds that so many of the civilization of the past have perished.

"*Gram Udyog Patrika*"

February, 1955.

XVIII

GREEN MANURING Vs. AMMONIUM SULPHATE

(*By Om Prakash Sharma*)

Before the introduction of inorganic fertilisers in India, organic manures, in the shape of dung and green leaves, were used for increasing the yield. But now-a-days fertilisers like ammonium sulphates are being used indiscriminately. It would be more proper if, before using these fertilisers, their values for increasing the yield and the various other effects, which these may have on the soil, were first evaluated. It would be also desirable before using the fertilizers and green manuring. But today the use of fertilizers is recommended to our farmers though they do not possess all this knowledge.

It is a matter of satisfaction that some experiments have been carried out at the Central Rice Research Institute, Cuttack, in this direction. An experiment has been in progress at this institute for the last three years to determine the comparative efficiency of ammonium sulphate application and green manuring with Dhanicha (sesbania aculcata). In 1935 it was estimated, by Shri K. Ramiah, that in soils of average fertility, by the application of green manures in the paddy fields, the increase in yield may amount to 8 to 10 per cent, while in poorer soils it may extend from 20 to 25 per cent.

Again in 1951, Shri M. S. Siwaraman wrote an article in Indian Farming on increasing paddy production in Madras. In this article he had stated that the yield of paddy could be

increased by 10 to 40 percent if 4,000 to 6,000 lbs. of green leaves are puddled in the field just before transplanting paddy.

According to the results obtained at the Central Rice Research Institute, both the organic manure dhanicha, as well as the inorganic fertilizer ammonium sulphate, give fairly good response, but green manuring by itself has given better response than ammonium sulphate on equal nitrogen basis. In this context it is interesting to note that 10 lbs. nitrogen as green manure (the amount of green manure which gives 10 lbs. nitrogen to an acre of land) alone gives good results and compares favourably with the 20 lbs. nitrogen as ammonium sulphate. In both the cases the increase in response is only up to 20 lbs. nitrogen per acre (i.e. the amount of green manure or ammonium sulphate which gives 20 lbs. of nitrogen to an acre). Beyond this there is practically no increase in the yield. At the 20 lbs. nitrogen per acre level it has been found that the increase in yield is 27.4 for every lb. of nitrogen made available by green manure—while the corresponding increase in the yield is only 21.9 lbs. When ammonium sulphate and green manure to be added to the fields was calculated on the availability of free nitrogen from them, the percentage of free nitrogen in ammonium sulphate is 20 to 21 and in dhanicha is 0.4 respectively.

It has been found that in the case of ammonium sulphate the increase in yield is due to the supply of nitrogen it gives to the crop. But in the case of green manure not only it supplies nitrogen to the field but it also gives other nutrients to the plants and adds humus to the soil. Mr. A. B. Stewart in his Report on the soil fertility investigations in India has stated that in heavy deltaic soils the benefit of green manuring appears to be associated with improvement of tilth and other physical properties rather than the chemical properties of the soil, while

in lighter soils both chemical and physical improvements appear to be involved.

Thus we see that our age old methods of supplying green manuring to the soil before seeding are of far greater use. The green manuring not only provides the nitrogen needed by the soil but it helps the soil in many other ways by supplying nutrients and adding humus. Ammonium sulphate does only one work i.e. supplying nitrogen to the soil. Besides this we do not know what effects it has on the bacterial population of the soil which imparts fertility to it. Our experience shows that our simple farmers by dosing and over-dosing their fields with ammonium sulphate have become instrumental in destroying the fertility of their own fields. Before advising the farmers to use ammonium sulphate in their fields we must make sure that it will have no far-reaching ill effects on the fertility of the fields which are the only means of livelihood to the 290 million village population of India.

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THE COW IN OUR ECONOMY

PART III

BULLOCK TRANSPORT

XIX

BULLOCK CARTS NOT ALLOWED

The technique of how the rich exploit the weak was spotlighted at the time of my visit to New Delhi to attend the Planning Commission Advisory Board. The Planning Commission office is located in the South wing of the Rashtrapati Bhavan. From the station I took a tonga and after dropping my luggage at my lodging place asked the driver to proceed to "the Lat Sahib's Mahal". The driver replied, "I am a poor man. I shall get into trouble if I drive you there as tongas are not allowed." I assured him I would see him through. He took courage and drove on and went past the two secretariat blocks and was about to turn left to the Viceregal Lodge gates when a sikh young man authoritatively commanded the driver to get off that road. I told him that that was a public highway and I had every right to use it and asked what authority he had to turn me away especially as he was not even in police uniform to regulate traffic and I ordered the tongawala to proceed. The intruder now climbed down and explained that "Panditji" was to pass that way to preside over the Planning Commission Meeting and he was only clearing the way for him. Then I informed him that I too had to attend that very meeting and what was more I had to be there before Panditji got there so that I could have the privilege of standing up when Panditji enters. Laughing at my retort he allowed the tonga to proceed.

A few yards further, at the forbidding gates, was a military sentry, bayonet, boots, brass buttons all complete. He stood across the road and ordered to get outside the railings as tongas were not allowed inside those sacred precints of the

first citizen. I countermanded that order to the tongawala. The sentry demanded a pass from me. I replied I held no such thing. He told me I could not enter those grounds without a pass. I explained that I had been summoned to attend the Planning Commission Meeting so I had to go. He replied that he had orders to let the invitees go in but not tongas. I refused to get off and walk the distance. When the altercation was well on, a police officer intervened and brought some reason to bear on the military orders, I was then allowed to pass.

A few yards further the traffic policeman also stopped the tonga. On my explaining the situation and strengthening my position by pointing out that at the first entrance he had noticed that a police officer has passed me, he agreed to let us proceed.

The last hurdle was another military sentry a few yards from the entrance to the office. There too we were held up till the Planning Commission office attendants rescued us.

In spite of my protest to the Secretary and his subsequent communication with the Military Secretary, this performance was repeated the next day also, when I threatened to arrive the next day if the meeting continued in a bullockcart! I pointed out that it was the height of absurdity and absolute lack of planning to hold a meeting at a place to which the members had no free access.

At the afternoon session that day the question of Roads came up. On being invited to offer my remarks I regaled my experience of getting to the meeting in a tonga. I told Panditji that a bullock cart driver in a democracy was as good a citizen as the Prime Minister himself and that it was an insult to deny him the use of a public road as was done in New Delhi in such roads as Ferozeshah Road.

Then Jawaharlalji interrupted to say he fully agreed that every citizen was equal in a democracy and that no privileges could be denied a bullock cart driver. But he submitted that I had misunderstood the purpose behind the notice board "Bullock Carts Not Allowed". He suggested this restriction was placed in the interests of the bullock cart drivers themselves as those roads were frequented by military lorry drivers and accidents might happen in which the bullock carts would be the worse sufferers. I replied, "Sir, you are a lawyer used to special pleading but to a simple man like me your argument looks upside down. When there are two persons in a public place and the presence of one is likely to be a menace to the other my common sense would lead me to restrain the source of danger rather than the possible victim. Accordingly I would put up a notice "Motor Cars And Lorries Not Allowed", and thus protect the bullock cart drivers. This evoked a peal of laughter.

This incident shows how even a simple situation is twisted out of recognition to suit the vested interests and the under-privileged is told that he is being deprived of his rights acquired at his own costs in his own interests. This was the old British Trusteeship argument still perpetrated under our "Freedom". When will these frauds on the public cease and citizens be allowed to enjoy the newly acquired rights of the full equality and justice?

"*Gram Udyog Patrika*".

September, 1951.

XX

PNEUMATIC TYRES FOR BULLOCK CARTS

To consider the advisability of replacing iron tyred wheels of bullock carts by pneumatic tyred wheels, it is necessary for us to consider the various aspects of this case.

May we for a moment stop to consider dispassionately the problem from the view point of the bullocks and from that of the villagers, its finances etc ? However unsophisticated these views may be, yet they are the parties most affected by our conclusions and therefore merit our attention.

The Bullock's View Point :

The dynamics of the question can prove nothing unless we consider them in terms of life. The best way of testing the efficiency of pneumatic tyred carts is not by calculating mathematically the load and the pull, but to compare the performance of the same pair of bullocks under exactly the same circumstances excepting for the change in wheels. Such experiments were carried out at the Government Cattle Farm at Hissar. On *Pucca* road, with a load of 2,000 lbs., a distance of ten miles was covered in four hours and five minutes by the cart with ordinary country cart wheels, and in two hours and fifty eight minutes with pneumatic equipments. This works out to 27.3% increase in efficiency. On *Kachha* road the performance took four hours and fifty six minutes with the country cart wheel, and three hours and forty minutes with pneumatic equipment, thus showing a 25.3% increase in efficiency (vide the Imperial Council of Agricultural Research Publication, Agriculture and Live Stock in India Vol. V, Part VI, page 636).

The roads for bullock traffic should be level but may wind round to avoid heavy gradients, while a motor road of any gradient may be negotiated by a change of gears in the car, but for its speed the road should be straight. These two requirements clash. The pull on the bullock becomes very heavy on a rising gradient. This disadvantage is accentuated when the cart has more freely moving wheels with ball bearings. Hence a cart loaded for a level road puts a considerable strain on the heart of the bullocks while pulling over a gradient. Therefore, a rubber tyred cart should not be fully loaded. Hence the mechanically calculated load has to be considerably lower in practice.

An ordinary cart with iron tyre will cost Rs. 450/- while the extra cost for change of wheels with rubber tyres and tubes will amount to about Rs. 450/-. That is, with an increase in cost of cent per cent we get an increase in efficiency of 27.3% on pukka roads and 25.3% on kachha roads. What businessman in his senses will go in for such an equipment ? Is it not simpler and much more economical to get two country carts with an increase of 100% efficiency than get the pneumatic equipment with 25.3% increase only ?

Apart from this, the Hissar experiment seems to have overlooked the advantage of roller bearings of the pneumatic tyre equipment. If the country cart wheel could be fitted with such bearings, only then could we compare on exact terms the actual merits of pneumatic tyres over iron tyres. The Central Industrial Workshop of the Government of Mysore carried out such an experiment and the result showed that the bullocks covered the distance of five miles in much less time with iron tyres and roller bearings (I have not the exact figures at hand but it was about 20% less.). The only difference being in the

tyre, the rubber tyre was thus found to be definitely a disadvantage. If this is correct, then when we are asked to fit carts with pneumatic tyres, we called upon to pay double for a lowering of efficiency !

The Villager's View Point :

Consideration based on commonsense will also support the findings of the Central Industrial Workshop. There are two main reasons why pneumatic tyres are used in motor vehicles. One is to afford an air cushion to absorb the shock incidental to fast traffic and thus reduce the strain and stress on delicate machinery. In a bullock driven vehicle this function of the pneumatic tyre is wasted, as there is no delicate machinery to be protected against shocks.

The other reason lies more in the quality of rubber. Because of its elasticity and pliability when pressed on a surface it enters the interstices and obtains a grip. This gives rubber its non-skidding quality. Put in other words, rubber does not slip, which means the friction on any surface is increased by the use of rubber. If any one disputes this fact, let him try to drive a motor car with iron tyres on the driving wheels. He will find that the car will hardly move as the wheels will revolve slipping over the road surface. When a car moves at thirty miles per hour, the wheels push off the earth under it at that speed, and to do so a tremendous grip is necessary and this is obtained by using rubber. Therefore the friction of rubber over road surface is greater than the friction of iron over the same surface. This means, other things being equal, that a rubber tyre makes the cart harder to move than an iron tyre, which is what is proved by the Mysore experiment.

We can deduce the same conclusion from the Hissar experiment too. For, if our proposition is correct then the rougher

the road the greater will be the friction caused by rubber. We found that according to the Hissar experimentt he apparent advantage of pneumatic tyres, without allowing for the roller bearings, on Pukka road was 27.3% and on Kachha road 25.3% only. That means that its efficiency is less on bad roads, which proves our supposition If it were otherwise the iron would have shown off at a greater disadvantage over the kachha road, which is not the case.

The Economic View Point :

When two surfaces rub on one another, the softer material takes the wear. When iron works on stone, the stone takes the wear needs to be replaced. If rubber works on stone the wear is on the rubber. Therefore given the same quantity of work, when the cartman uses iron tyres the wear that he has to replace is much less than when he uses rubber. The use of rubber tyres in effect shifts the burden of wear and tear on the individual cartman from the shoulders of the government in so far as the cartman has to renew the rubber tyres frequently while the road is saved from wear and tear. This becomes an additional direct tax, as it were, on the cartman.

Who needs the good roads ? The motorist, for speed to save him from jolts. Who wears out the road ? The motorist, by enormous kick backward of the driving wheels to send the car forward at high speed. The driving rubber wheels create a vacuum which causes a suction that raises dust and wears out the road material.

The cartman's wear is caused by merely rolling motion which is always at a minimum. Therefore the advocacy of rubber tyres for carts is in effect directed towards shifting the burden of expensive surfacing of good roads from the motorists to the already exploited villagers.

The Artisan's View Point :

Many Municipalities and local bodies have gone in for rubbish van and night-soil carts mounted on wheels with pneumatic equipment. Besides all the above reasons against such fittings, there is a fundamental error in the application of the principles of public finance involved in such a course. Taxes must be spent for the benefit of the tax-payers generally, and such public expenditures should promote and encourage the well-being of the people. For obtaining pneumatic equipment the tax-payer's money is spent abroad or to support large-scale industries while the local carpenters and the black-smiths are deprived of their trade and will be ultimately driven to increase the already existing high pressure on land. The tax-payers in their own interest should discountenance the use of their money by local bodies in such a way as to be detrimental to the interest of their own artisans.

The Finance View Point :

The writer in the Imperial Council of Agricultural Research publication referred to above says :

"The most serious obstacle to the rapid adoption of pneumatic equipment for transport purposes in this country is poverty. So far as the average peasant is concerned, new types and patterns of vehicles are at present quite out of the question. It is quite sufficient to expect him to raise Rs. 150/- for a set of pneumatic tyres and equipment, (the present price will be Rs. 450/-) without telling him that he will also want a new type of cart, the design and building of which his local carpenters and blacksmiths may know nothing whatever about."

What ignorance of the financial condition of the villager this discloses ! To expect a farmer to raise several times his average *per capita* debt for a set of pneumatic tyres and equip-

ment ! Even if this amount could be raised, have they no better alternative use for the money ?

A change over from iron to rubber tyres will call for a larger mileage of tarred or concreted roads. This will increase the expenditure on road making.

Villagers will be well warned against all forms of high pressure salesmanship advocating the use of products of large-scale manufacture. Already our country is denuded of various forms of industry. As long as artificial economic barriers, such as freight rates and discriminatory tariffs exist, it would be suicidal to venture into distant markets either to buy or to sell.

In short, pneumatic tyres are harder on the bullocks, shift a larger proportion of the burden for road repairs than is proper on the villager, are beyond his financial capacity, this course will displace village artisans, and to buy such equipment is hard financial policy for us to follow. This suggestion, therefore, is unsound on all counts.

"*Gram Udyog Patrika*"

February, 1956.

XXI

ECONOMICS OF TRANSPORT

(*By Champa Lal*)

We are developing motor transport in our country with great speed, almost too much speed ; so much so, that within the last 3 or 4 years, the import of petroleum has doubled and it now occupies the first place in our imports. Motor transport is causing unemployment amongst the poorest classes, viz, grass cutters, tonga drivers, cartmen, carpenters and leather workers etc., as one motor means the displacement of 50 persons as against the employment of two—the bus driver and the cleaner.

Besides, a major portion of the money spent on such transport by the public, goes out of the country. Motor transport is also causing ill-health and tuberculosis, especially in big cities like Delhi, by the continual fouling and poisoning of the atmosphere, by poisonous exhaust gasses.

Further, motor transport leads to foreign economic domination and results in the gradual elimination of the indigenous road transport. We are allowing organised motor transport, even parallel to our railway lines and, for long distances, thus hitting our railways which is our biggest National Industry. This was not allowed in the British regime as they realized that it would lead to decrease in railway revenues.

One reason why America and England are so aggressive in protecting the so called 'free world' in Asia is because they are exploiting it economically by industries such as motor transport, which promote their business in motor vehicles,

rubber tyres and petrol, which is one of the causes of world wars.

Ways of meeting this situation have to be thought out and they are simple enough. Village transport has to be revived and encouraged.

Another associated matter of great importance is Road construction and Road Maintenance ; how and where roads are constructed and with what materials, indigenous or foreign. Unfortunately our engineers have been trained in foreign methods and techniques, with the result that they go in for foreign machinery, equipment and materials.

This is not intended to be an exhaustive note, but it is only to indicate that we should examine critically the economics of motor transport and be aware of its far reaching evil consequences.

By our present ill-thought out policies and methods, we are moving more and more into the clutches of the Anglo-American Block without being aware of it. The result will be disastrous. It is bound to increase unemployment and misery in the country.

" *Gram Udyog Patrika* "

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Cattle at the present moment go to the slaughter houses because of our criminal negligence and want of proper knowledge. The saving of an enormous number of cattle is more a problem of economics than religion ; and there is no conflict between them. A religion which is in conflict with fundamental economics is bad, and in the reverse way economics that are in conflict with fundamental religion are also equally bad.

—GANDHIJI

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